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(54) **Headphone for surround sound effect**

(57) A headphone comprising two earphone members positionable about the left and right ears of a listener's head is described. Each of the headphone members is provided with at least two loud speakers. a first loud

speaker being arranged facing and forward of or adjacent to the pinna of the listener's ear and the second loud speaker being arranged facing and rearward of the pinna of the listener's ear.

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Description

This invention relates to a headphone. In particular, this invention relates to a headphone designed to recreate a surround sound effect.

Surround sound arrangements are known in which a listener is provided with two or more speakers forward of the listener and two or more speakers rearward of the listener. This arrangement can provide a realistic expansion and motion of sound in the home, particularly as it can provide for the dividing of sound between the speakers. The surround sound effect has been recently effectively utilized to accompany visual effects in media such as video and television programmes.

There are several disadvantages with this multi-speaker system. Firstly, for maximum enjoyment the listener must sit in a precise position in relation to the speakers, that is approximately equi-distant from all four (or more) speakers. Secondly, for the surround sound effect to be exhibited, it is necessary for the room in which the arrangement is set up to be reasonably large in order to create a suitably large sound volume. Thus, the arrangement does not work satisfactorily in very small rooms; and thirdly, all people in the room must listen to the surround sound system when it is on.

It is therefore an object of the present invention to overcome the above difficulties or disadvantages, or at least to provide the public with a useful choice.

Accordingly, the present invention can be said to broadly consist in a headphone having two earphone members positionable about the left and right ears of a listener's head, each of the earphone members being provided with at least two loud speakers, a first loud speaker being arranged facing and forward of or adjacent to the pinna of the listener's ear and the second loud speaker being arranged facing and rearward of the pinna of the listener's ear, such that the central axes of the loud speakers intersect at an angle greater than 90° and less than 180° .

Preferably the central axes of the second loud speakers are substantially perpendicular to planes through the pinna of a listener's ear.

Preferably each earphone member substantially follows the curve of the listener's head so that the central axis of the second speaker is substantially parallel to a plane through the pinna of the listener's ear, or intercepts that plane at an angle of between $0-45^\circ$.

A preferred embodiment of the present invention will now be described with reference to the accompanying drawings in which

Figure 1 is a perspective view of a headphone of the present invention on a listener's head.

Figure 2 is a side view of one earphone of the headphone of Figure 1.

Figure 3 is a cross-section through a first embodiment of a headphone of the present invention.

Figure 4 is a cross-section through a second embodiment of a headphone of the present invention mounted

on a listener's head:

Referring to the drawings, Figures 1 - 4 show a headphone indicated generally at 100 having two earphone members 110 and 120, each earphone member having a pad 130 which surrounds an ear on the head 140 of a listener. Each earphone 110 and 120 is provided with at least a front loudspeaker 150 and a rear loudspeaker 160 (see figures 3 and 4). Each speaker 150 and 160 is enclosed in a chamber defined by a partition 170, 180 which may be formed partly of a rigid substance to assist in holding the speakers in place, and partly of a thin permeable material which acts as a dust barrier. Other conventional speaker enclosing arrangements are also envisaged.

In order to approximate the situation in a room where listeners have at least two speakers forward of them and at least two speakers rearward of them, the first speakers 150 are positioned either forward of or adjacent the pinna of each of the listener's ears; and the second speakers 160 are placed rearward of the pinna of the listener's ears, preferably towards the back of the head.

Further, again to more closely approximate the situation in a room with a four (or more) speaker set up, the central axis of each first speaker 150 and the central axis of each second speaker 160 preferably intersect at an angle greater than 90° and less than 180° , as is indicated in Figures 3 and 4 by angle α . In the second headphone embodiment shown in figure 4, the second loudspeakers 160 are placed in a position where the central axis of the loudspeakers 160 is perpendicular to or substantially perpendicular to a plane through the pinna of the listener's ear. The speakers all face the listener's ears, of course.

The arrangement of the loud speakers shown in the drawings has the added advantage that sound is transmitted without delay from the forward loudspeakers to the listener's ear, whereas sound is transmitted with some delay from the rear loudspeaker to the ear which gives a very realistic effect.

The arrangement and functioning of the loudspeakers is conventional and may be arranged in a number of ways, it would be clear to a person skilled in the art to which this invention relates. Suitably, a full frequency range is emitted by each of the forward and rearward loudspeakers, which obviates the need for any partitions or filters between the forward and rearward loudspeakers, required in known headphones of this type.

The speakers may be attached to a sound source by a cord or cords. Alternatively, the headphones may be cordless in which case the loudspeakers, for example, would receive an infra-red signal from the transmitter connected to the sound source. Further, some of the speakers may be attached by a cord to the sound or radio frequency source and some of the speakers may be cordless.

If the headphones are to be cordless, they will also need to be equipped with receivers. In preferred embodiment, the receivers will receive two channels on one fre-

quency, so instead of transmitting the information to each loudspeaker separately on four different channels, two channels can be used. This minimizes the possibility of interference of channels with each other. Preferably, the two forward channels would be combined to form a single forward loudspeaker signal and the two rearward channels would be combined to form a single rearward loudspeaker signal.

With this arrangement, the headphones of the invention can be provided with a switch which can allow all four loudspeakers to receive a remote signal, or which can allow only the forward or only the rearward loudspeakers to receive a signal. In this way, the stereo sound from, say, a compact disc player, can be transmitted on the forward frequency and the stereo sound from a television, say, can be transmitted on the rearward frequency. two listeners can then separately listen to the television and the compact disc through different headphones at the same time.

The above describes a preferred embodiment of the invention variations and modifications in which may be made without departing from the scope of the invention as defined herein.

For example, each earphone 110, 120 may contain more than two speakers.

Thus, it is clear that the headphones of the present invention provide a convenient manner of replicating the surround sound effect in a headphone whilst allowing the listener the freedom to listen to a sound from sound source creating the surround sound effect in a small area: whilst not disturbing others; and whilst being able to move around a room.

Claims

1. A headphone comprising two earphone members positionable about the left and right ears of a listener's head, each of the headphone members being provided with at least two loud speakers, a first loud speaker being arranged facing and forward of or adjacent to the pinna of the listener's ear and the second loud speaker being arranged facing and rearward of the pinna of the listener's ear.
2. A headphone according to Claim 1 wherein central axes of the first and second loudspeakers of each of the headphone members intersect at an angle greater than 90° and less than 180°.
3. A headphone according to Claim 1 or 2 wherein the central axes of the second loudspeakers are substantially perpendicular to planes through the pinna of the listener's ear.
4. A headphone according to Claim 1 or 2 wherein each earphone member substantially follows the curve of the listener's head.

5. A headphone according to Claim 4 wherein the central axis of the second loudspeaker intercepts a plane through the pinna of the listener's ear at an angle between 0-45°.

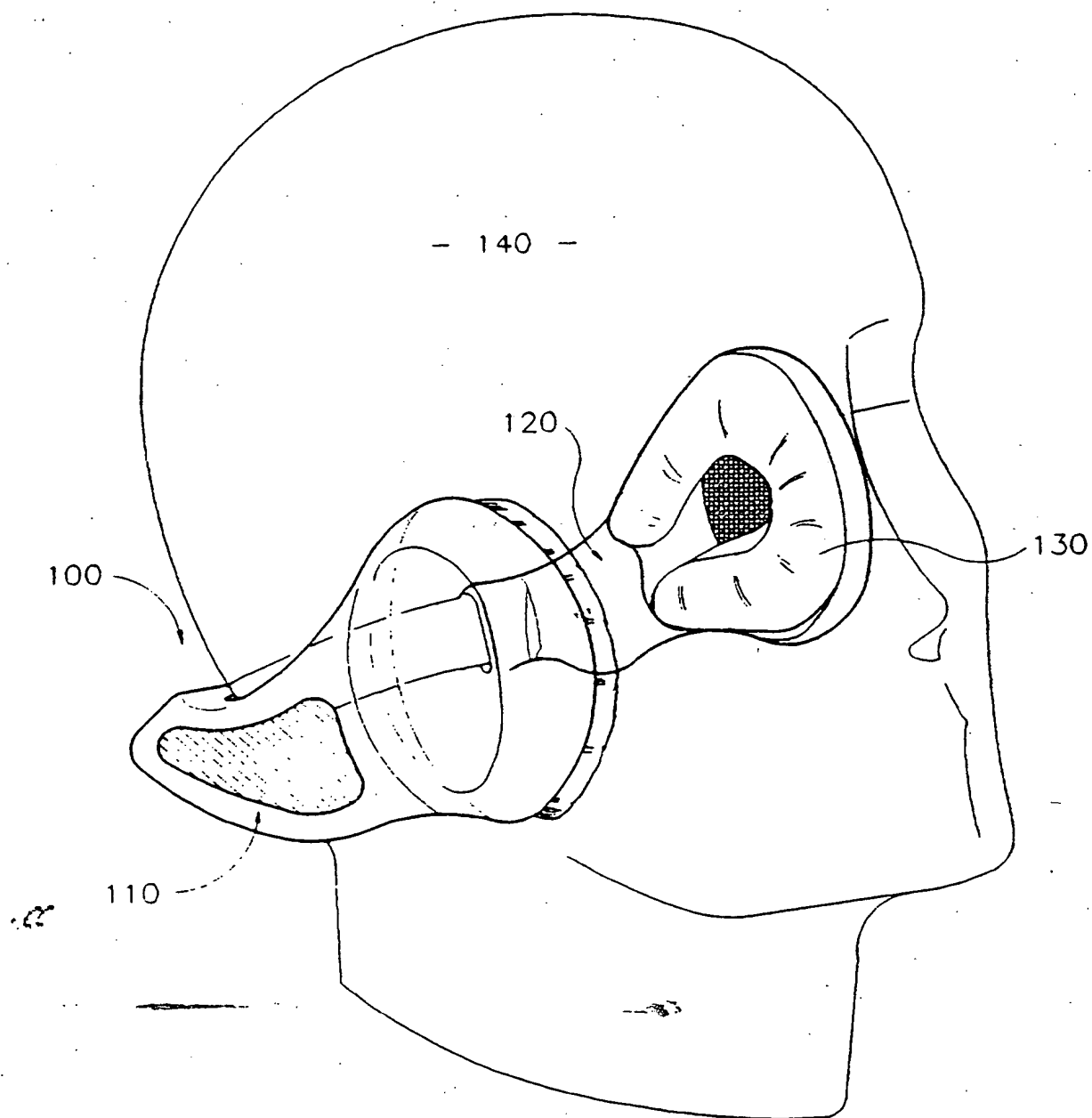


FIG. 1

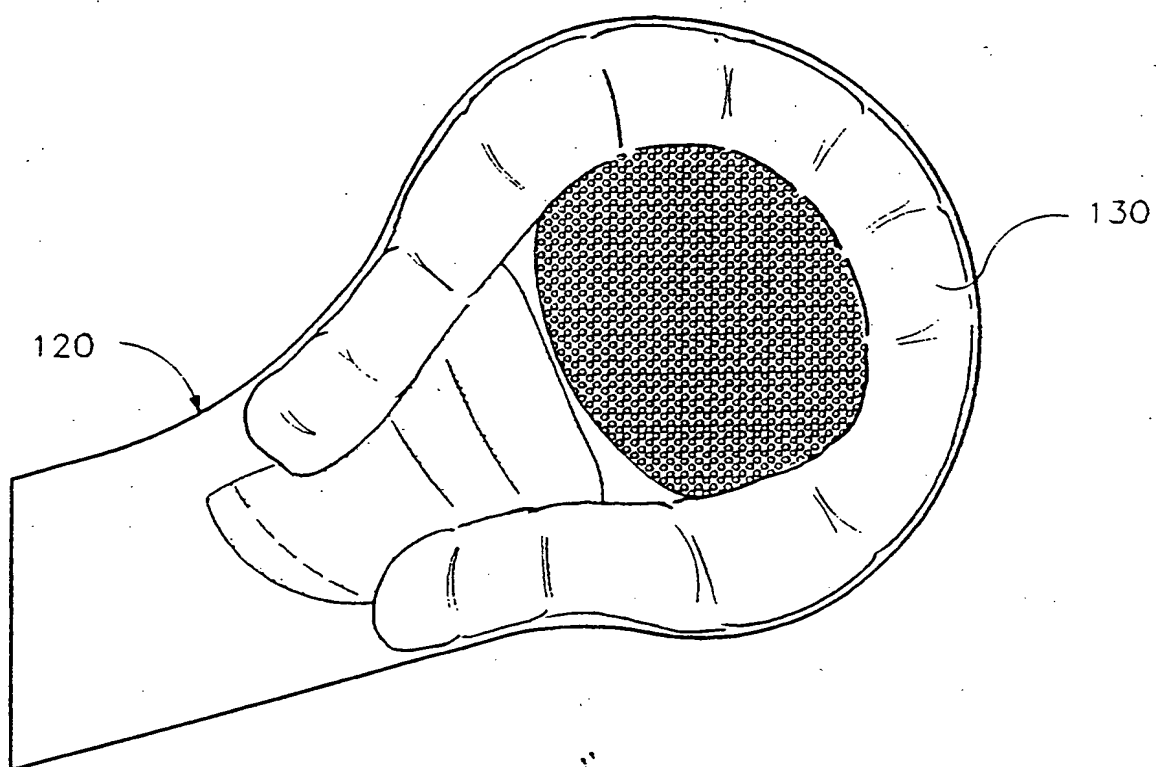


FIG. 2

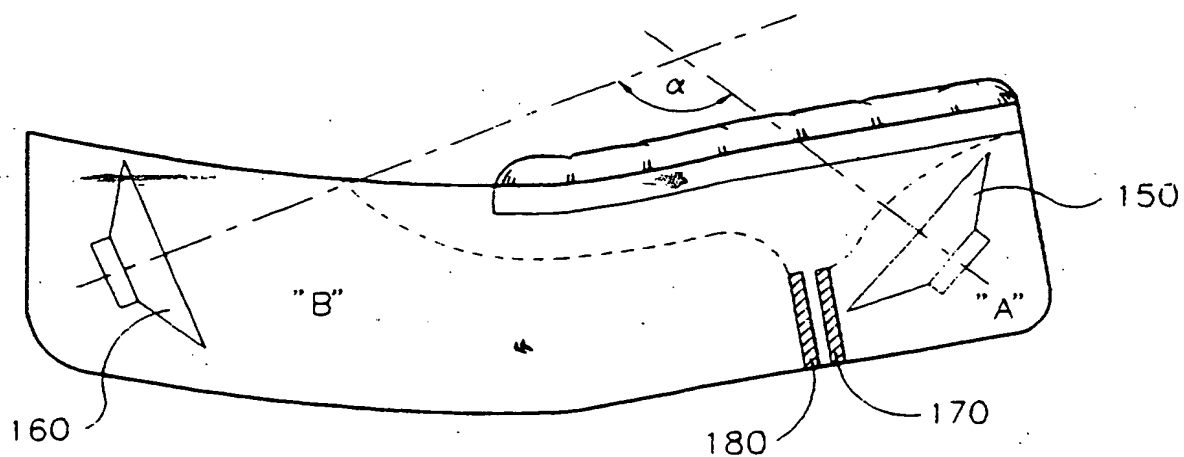


FIG. 3

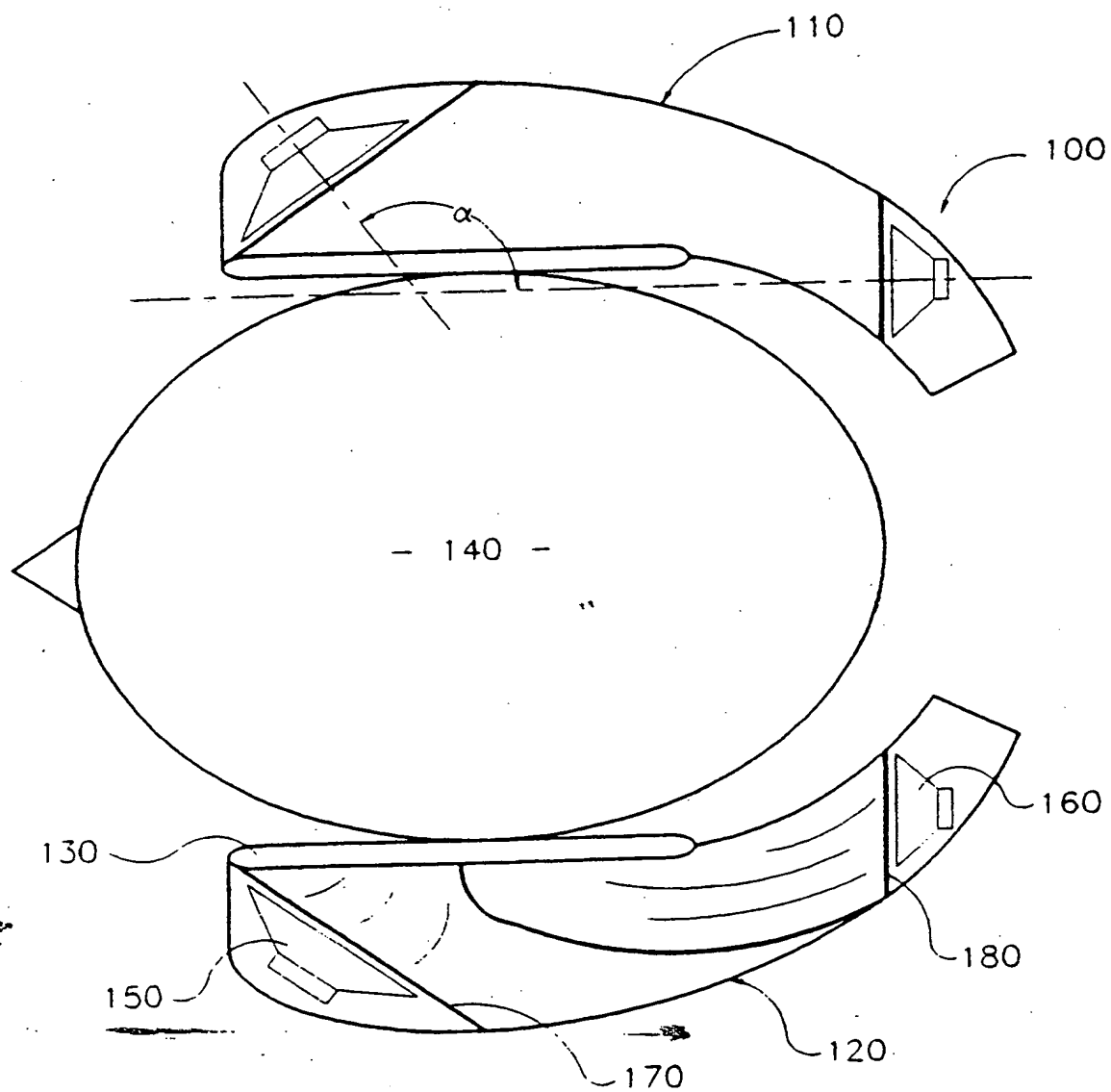


FIG. 4

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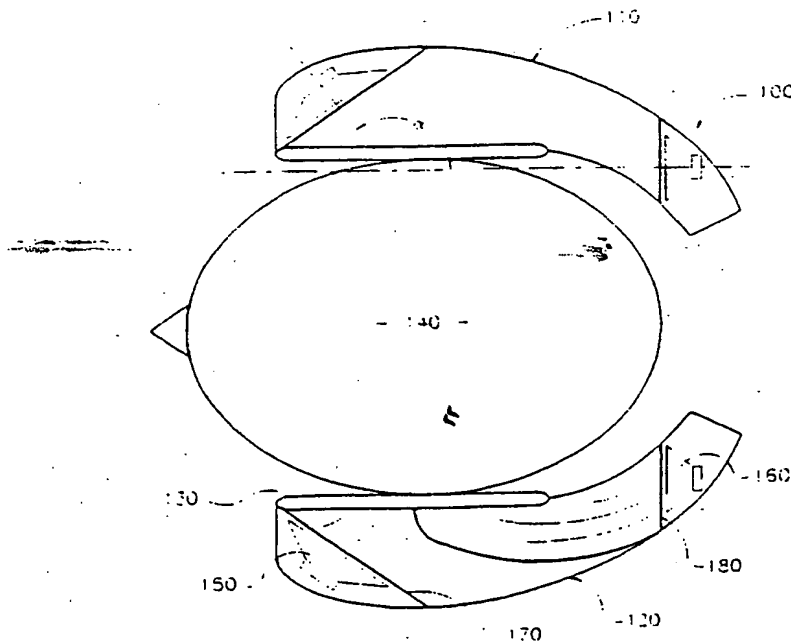


FIG. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 95 30 6846

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US-A-4 110 583 (LEPPER) * column 7, line 39 - line 50; figure 5 * * column 8, line 66 - column 9, line 14; figure 10 *	2,3	H04R5/033 H04R1/10
X	US-A-3 900 707 (HANSON) * column 2, line 43 - line 55; figure 4 * * column 3, line 2 - line 16; figure 4 *	1,4,5	
A	US-A-3 927 262 (GOECKEL) * column 5, line 4 - column 6, line 13; figure 1 *	1-5	
A	US-A-3 984 636 (TURNER) * column 2, line 67 - column 4, line 13; figures 1-4 *	1-5	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			H04R
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		5 July 1996	Gastaldi, G
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document I : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date U : document cited in the application F : document cited for other reasons & : member of the same patent family, corresponding document			

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